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A National Web Conference on the Use of Clinical Decision Support to Improve Medication Management

January 28, 2014

12:30pm – 2:00pm ET

Moderator and Presenters Disclosures

Moderator:

Erin Grace, M.H.A.*

Agency for Healthcare Research and Quality

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*Have no financial, personal, or professional conflicts of interest to disclose.

‡ Dr. Trivedi would like to disclose that he has served as an advisor/consultant to or on the Speakers' Bureau for several commercial entities and has received research support from Corcept Therapeutics, Inc.

‡‡ Dr. Fiks would like to disclose that he is the co-inventor of the Care Assistant, the decision support software used in this study, but has earned no income from or holds no patent on this invention.

Measurement of Screening, Diagnoses, Treatment, and Outcomes Through Health IT

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Disclosure

I would like to disclose the following:

Advisor/Consultant/Speakers' Bureaus

Alkermes, AstraZeneca, Bristol-Myers Squibb Company, Cerecor, Concert Pharmaceuticals, Inc., Eli Lilly & Company, Forest Pharmaceuticals, Janssen Global Services, LLC/Janssen Pharmaceutica Products, LP/Johnson & Johnson PRD, Lundbeck, MedAvante, Merck, Mitsubishi Tanabe Pharma Development America, Inc., Naurex, Neuronetics, Otsuka Pharmaceuticals, Pamlab, Phoenix Marketing Solutions, Ridge Diagnostics, Roche Products Ltd., SHIRE Development, Sunovion, and Takeda

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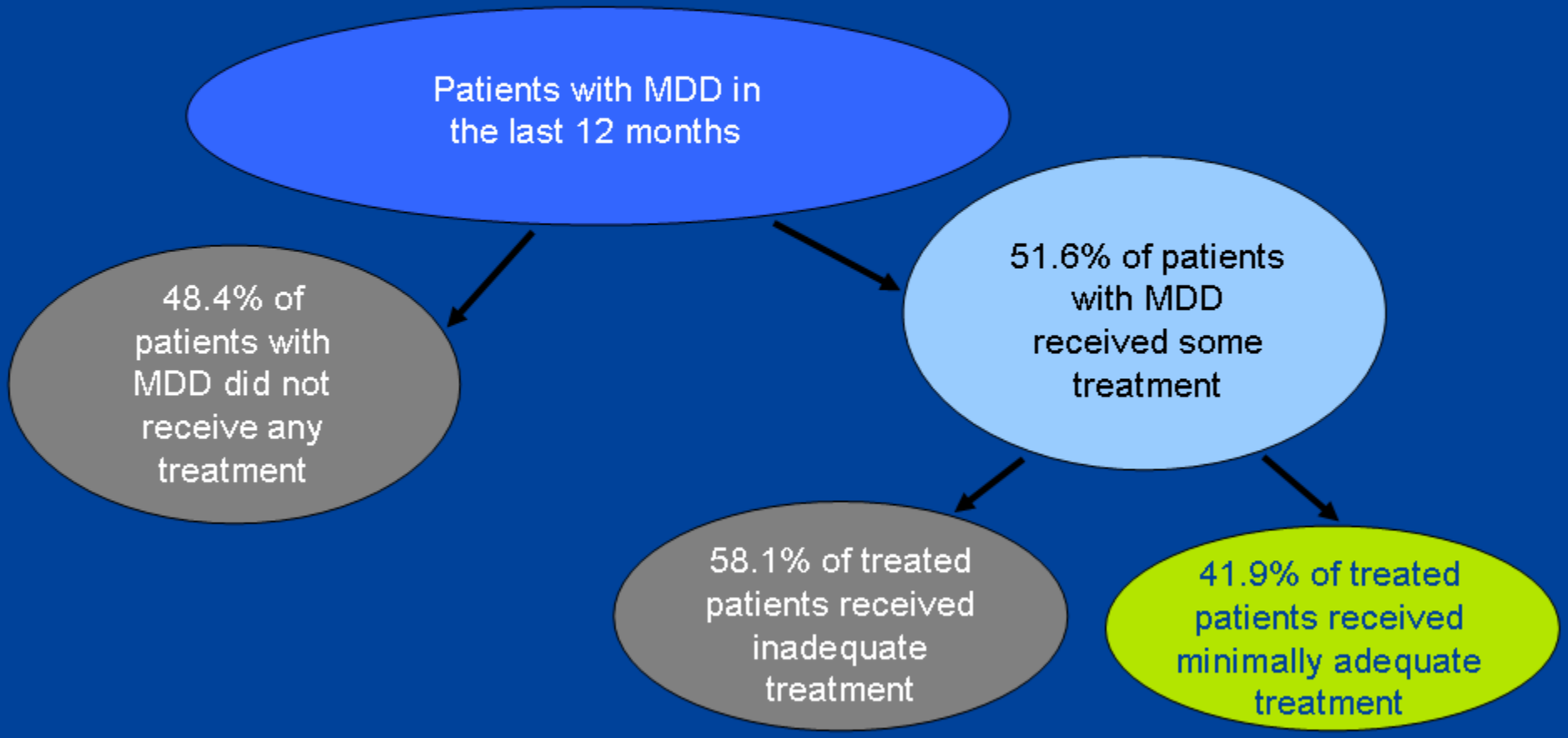
Major Depressive Disorder (MDD) is still largely untreated

- Only 21.6% of all MDD patients in this study received adequate treatment



Kessler RC, et al. *JAMA*. 2003;289(23):3095-3105.

Background

- Many new treatments for major depressive disorder (MDD)
  - Yet, only one out of three patients achieves remission
- Lack of truly novel treatments
- Variable practice patterns
  - Duration of treatment?
  - When to switch?
  - When to augment?
- No standardized method of assessing outcomes (symptom burden, side effects, and patient adherence) in real-world settings

New Guideline Recommendations for Treating Adults With MDD

- Two new MDD treatment guidelines emerged in 2010:
  - Updated APA Practice Guideline for MDD Treatment[1]
  - An international panel of psychiatric experts gathered and outlined a universal treatment algorithm for MDD[2]

- Guidelines recommend:[1,2]
  - Switching or augmentation after an inadequate response to an optimized initial antidepressant trial
  - Using measurement-based care to detect unresolved symptoms
  - Atypical antipsychotics, rTMS, and exercise

APA=American Psychiatric Association.

1. American Psychiatric Association. Practice Guideline for the Treatment of *Patients With Major Depressive Disorder*. Arlington, VA: American Psychiatric Association; 2010 ; 2. Nutt DJ et al. *J Clin Psychiatry*. 2010;71[suppl E1]:e08.

New APA Guidelines for the Acute-Phase Treatment of MDD

Start of Medication Trial and/or Psychotherapy

↓

4-8 Weeks: Reassess Adequacy of Response

Full Response

Continuation-phase treatment

Partial Response

With medication:
- Optimizing the current treatment (Level I)
- Switching antidepressant (Level I)
- Augmenting with a second agent (Level II/Level III)

With psychotherapy:
Adding or changing medication, changing intensity or type of psychotherapy

No Response

With medication:
Changing antidepressant, adding or changing psychotherapy, ECT

With psychotherapy:
Adding or changing medication

Level I=Recommended with substantial clinical confidence; Level II=Recommended with moderate clinical confidence; Level III=Low evidence base, recommended on the basis of individual circumstances.

ECT=electroconvulsive therapy.

American Psychiatric Association. *Practice Guideline for the Treatment of Patients With Major Depressive Disorder*. Arlington, VA: American Psychiatric Association; 2010.

The Treatment of Depression

- Goal: full remission
  - Reduce symptoms of depression
  - Return patient to fullest possible life
  - Improve treatment of comorbid medical conditions
- Options

Pharmacologic	Psychotherapy	Other
Antidepressants	Cognitive behavioral therapy	ECT
	Interpersonal therapy	Phototherapy
		VNS
		rTMS

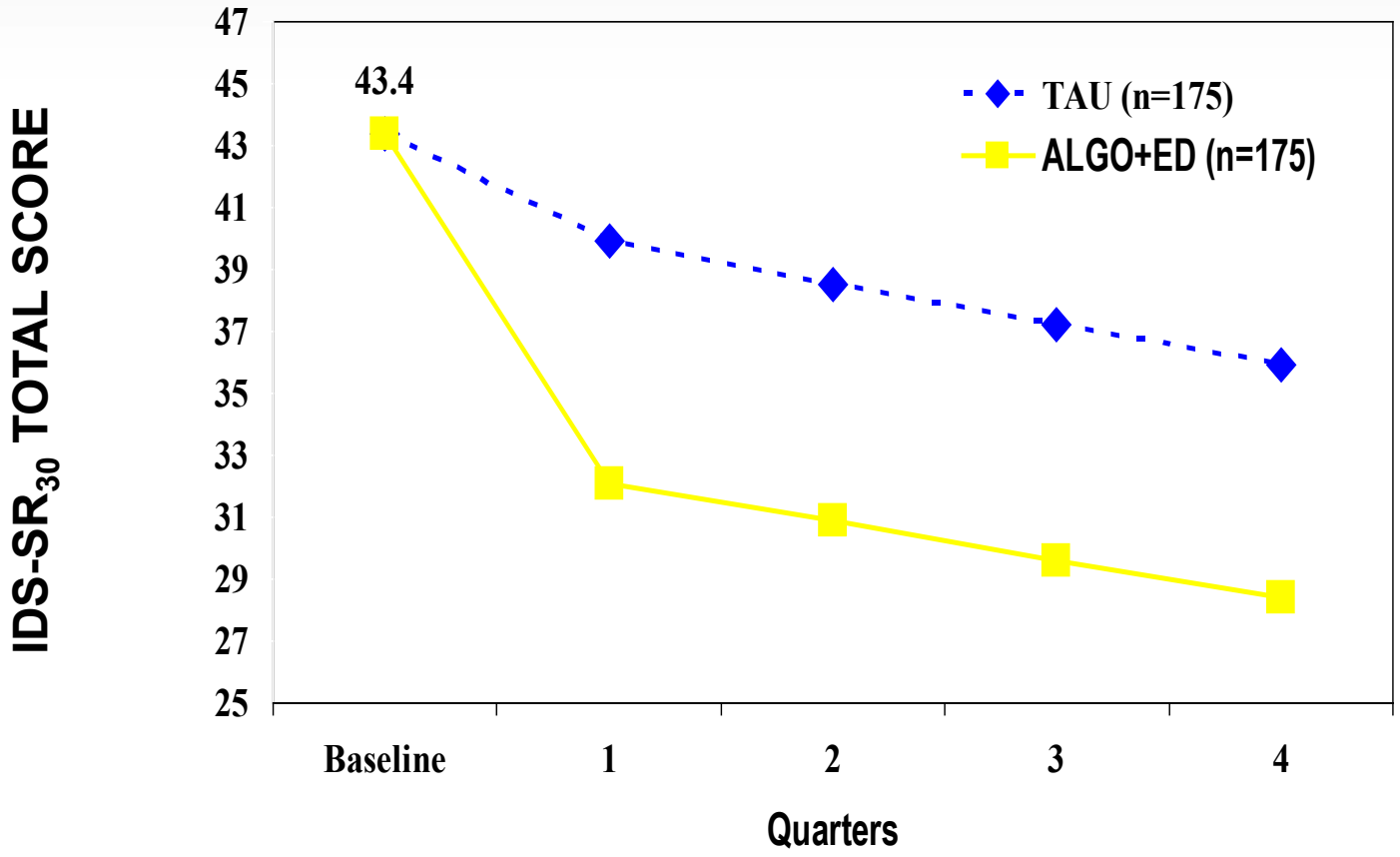
Depression Guideline Panel. Depression in Primary Care: Vol 2. Treatment of Major Depression. Clinical Practice Guideline No. 5. Rockville, Md: USDHHS PHS, Agency for Health Care Policy and Research; AHCPR no. 93-0550; April 1993; Rush AJ, Thase ME. Psychotherapies for depressive disorders: a review. In: Maj M, Sartorius N, eds. Depressive Disorders. New York, NY: John Wiley and Sons; 1999

Depression Algorithm

- Need to incorporate new treatments and new evidence
- Need to identify adequate trial duration
- Need to establish Measurement-Based Care (MBC) as reliable predictor of response/remission

Evidence-based consensus is needed to guide stages of treatment.

MDD-Adjusted Mean Symptoms ($IDS\text{-}SR_{30}$): All Subjects



Trivedi MH et al. *Arch Gen Psychiatry*. 2004;61(7):669-680.

AHRQ

Sequenced Treatment Alternatives STAR ★ D to Relieve Depression

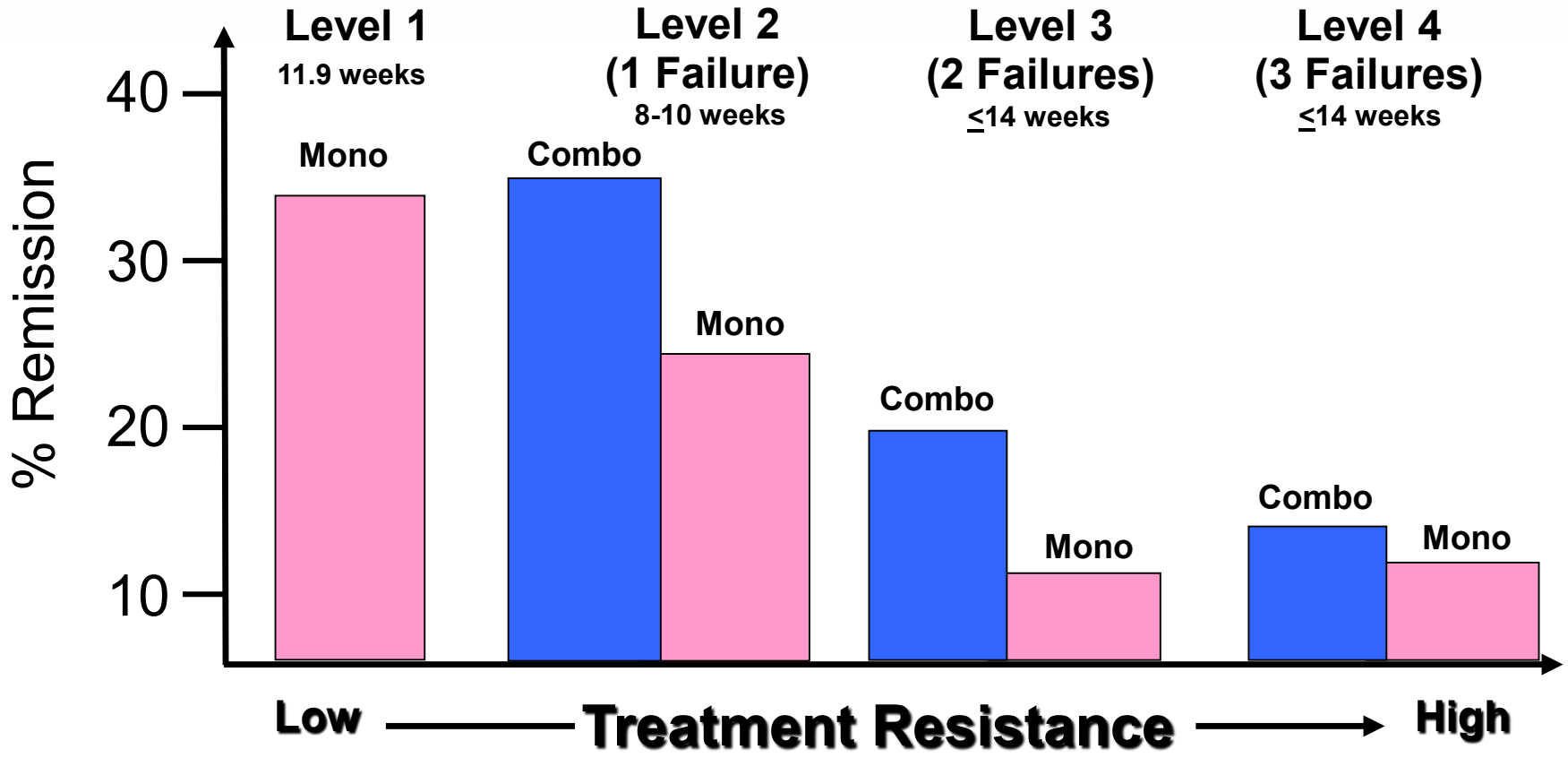
http://www.star-d.org

STAR*D Measurement-Based Care (MBC)

- Use standardized assessments to guide treatment decisions at regular time intervals:
  - Symptoms (QIDS−SR_{16})
  - Medication side effects (FIBSER)
- GOAL: Remission of symptoms (QIDS−SR_{16} ≤ 5)
  - Use MBC to increase remission in chronic depression
- Regular feedback to assist clinical decisionmaking

STAR*D Clinical Study Results

Remission Rates: Combination vs. Monotherapy



Mono = monotherapy
Combo = combination treatment

McGrath et al. 2006
Rush et al. 2006
Nierenberg et al. 2006
Trivedi et al. 2006a
Trivedi et al. 2006b

3429.02

MEASUREMENT BASED-CARE (MBC)

Rationale for MBC

- Treatment of MDD is often associated with wide variation among practitioners.
- Practitioners differ in how outcomes of treatment are assessed.
- Global judgments are often used instead of specific symptom assessments—even though the former are less accurate.

Components of MBC

- Standard assessments of symptoms, function side effects, suicide ideations;
- Use of critical decision points based on a state-of-the art algorithm for MDD;
- Consistent patient followup; and
- Performance feedback for clinical decisionmaking.

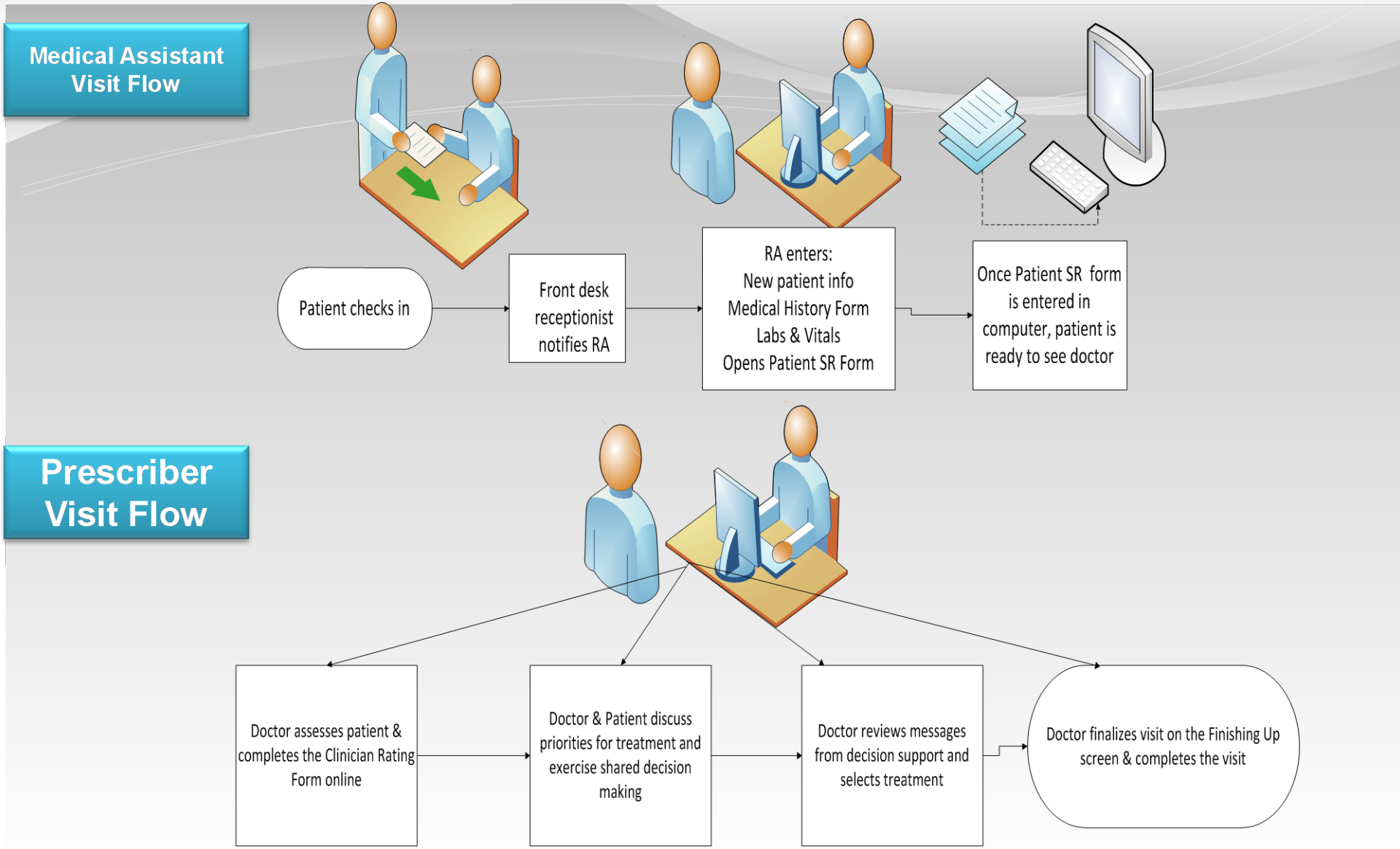
Mental illnesses are long term.

e-Decision Support System

- Integrates core components of MBC (symptom severity, side effects, and patient adherence) with the TMAP depression algorithm to provide a computer decision support system for depression (CDSS-D)
- Maximizes treatment delivery for MDD in outpatient care settings
- Making MBC strategies accessible and user-friendly for medical provider
- Readily available to physicians at time of care—when it is most likely to impact outcomes

Trivedi MH et al. *Contemp Clin Trials* 2007;28:192-212.

Patient Visit Flow Diagram



Compass
Patient Evaluation Screen

CompTMAP - [Patient Evaluation]

File Edit View Navigate Links Algorithms Tools Help

Back Forward Reload Home Help Notes Hx Dx Patient Rx Levels Scales Print

Charlie Brown, Week 3 of treatment (Wk 3 in Stage 1 Major Depressive Disorder: Psychotic)

Treatment Medications

Clinical Status

Function Symptoms Side Effects New Algorithm

10.00 8.00 6.00 4.00 2.00 0.00 1/14 2/4

Primary Meds

olanzapine/citalopram

40.00 35.00 30.00 25.00 20.00 15.00 10.00 5.00 0.00 5/20

60.00 55.00 50.00 45.00 40.00 35.00 30.00 25.00 20.00 15.00 10.00 5.00 0.00

01/14/2004 - 02/04/2004

All Meds | Primary/Aug | Assoc Sx | Side Effect | Hide DC

Algorithm Stages & Treatme...

- Amoxapine
- Atypical Antipsychot
  - aripiprazole
  - olanzapine
    - 5 mg
  - quetiapine
  - risperidone
  - ziprasidone
- Mirtazapine
- Selective Serotonin
  - citalopram
    - 20 mg
  - escitalopram oxa
  - fluoxetine
  - fluoxetine weekly
  - paroxetine
  - paroxetine CR

Most Recent Blood Levels / Notes

Name: Charlie Brown
Patient ID: 006
Date of Birth: 5/15/1952

AUTONOTE Encounter Date: 1/14/2004

Charlie Brown was seen for an initial visit for Major Depressive Disorder Recurrent Severe With Psychotic Features. For the algorithm, Major Depressive Disorder: Psychotic, on a 0 to 10 point scale, his symptom severity was rated 8, functional status was rated 2, and side effect burden was rated 0 at this visit.

2/4 | 1/14

Symptom Severity: 0 1 2 3 4 5 6 7 8 9 10

Functional Status: 0 1 2 3 4 5 6 7 8 9 10

Side Effect Burden: 0 1 2 3 4 5 6 7 8 9 10

Medications were
- Taken According to Instructions
- Taken Adequately but Not as Instructed
- Taken Inadequately

Patient is
- Markedly improved
- Modestly improved
- Minimally improved
- No worse
- Worse

Side Effects are — N/A
- Acceptable
- Require attention
- Unacceptable

02/04/2004 09:32 AM

Comments

Check for phone consultation | M.S.E. | Next ->

start | Microsoft PowerPoint ... | CompTMAP - [Patient... | 9:36 AM

Compass
Treatment Selection Screen

CompTMAP - [Treatment Selection]

File Edit View Navigate Links Algorithms Tools Help

Back Forward Reload Home Help Notes Hx Dx Patient Rx Levels Scales Print

Charlie Brown, Week 3 of treatment (Wk 3 in Stage 1 Major Depressive Disorder: Psychotic)

Treatment Options

Choose Treatment Option

- Continue dose
- Increase dose
- Decrease dose
- Go to new stage
- Continue+Add Augmentation
- Adjust Augmentation

Physician Override ☐

Side Effects Require Attention

Associated Symptoms Treatment

Current Evaluation

Charlie Brown – Major Depressive Disorder: Psychotic
Week 3 of treatment, week 3 in Stage 1

On a 0 to 10 point scale, Symptom Severity was rated 7, Functional Status was rated 3, and Side Effect Burden was rated 0.

Clinical Status markedly improved
Medications taken according to instructions
Side Effects acceptable

Messages from Decision Support System

citalopram
Continue Dose may be considered since the patient is markedly improved.
Continue Dose is recommended because the dose has not been at or above minimal therapeutic for 4 weeks.

olanzapine
Increase Dose should be considered since the current dose is less than minimal therapeutic dose.
Olanzapine doses are usually adjusted in 5 mg increments every 7 days.

Primary Syndrome Medications

Medication	Dose	For	Status
citalopram	20 mg	Primary	Continue
olanzapine	5 mg	Primary	Continue

Side Effect Treatment Medications

Associated Symptom Medications

Non Algorithm Medications

DC	Date	Medication	Dose/Day	UOM	Rationale

Add... Medication

Next->

Comments

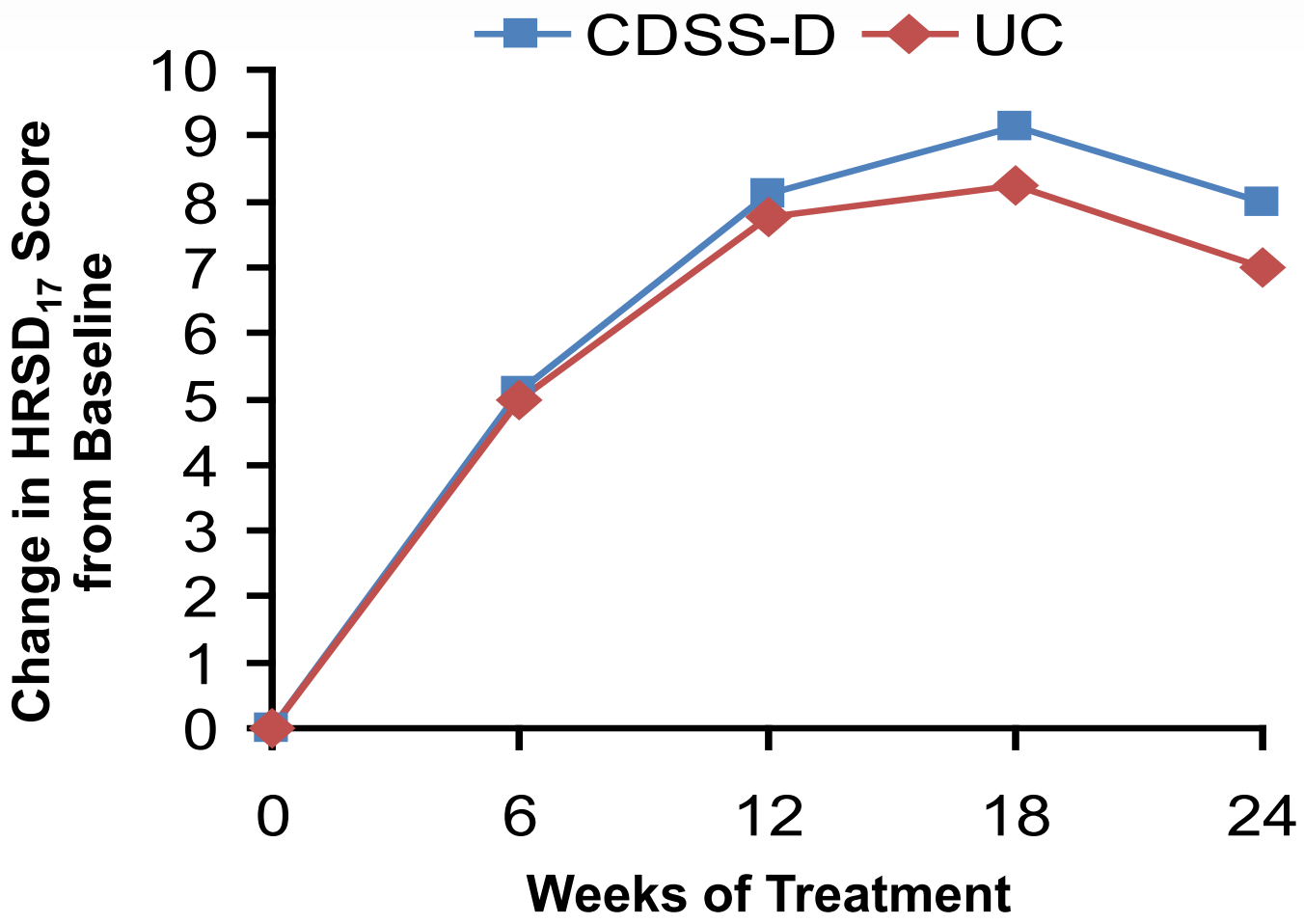
start Microsoft PowerPoint ... CompTMAP - [Treatm... 9:37 AM

Proof of Concept in Primary Care

- Evaluate the feasibility and effectiveness of implementing a CDSS in primary care to treat MDD
- Study settings and participants
  - 55 patients (32 treated with CDSS, 23 with usual care)
  - 4 physicians (2 for CDSS, 2 for usual care)
  - Primary outcome: 17-item Hamilton Rating Scale for Depression ($HRSD_{17}$)

Kurian B et al. *Prim Care Companion J Clin Psychiatry* 2008.

Predicted Change in Mean $HRSD_{17}$ Scores from Baseline for Patients Treated with CDSS and Usual Care



Kurian B et al. *Prim Care Companion J Clin Psychiatry* 2008.

MBC WITH ELECTRONIC DECISION SUPPORT:

Measurement-Based Care Guiding Evidence in Depression

Current Deployment

- Merging electronic decision support with EPIC to enhance integration of MBC into practice settings

- Intended to ensure a high degree of adherence to a tested pharmacological algorithm for the treatment of MDD

Questions

- How is treatment optimally implemented?
  - Adhering to set visit schedule and dose titration
  - Monitoring symptom improvement
  - Monitoring adherence and SEs

Decision-making Process

- Critical decision points (CDPs) determine next steps in clinical decisionmaking.
- CDPs: based on duration of treatment and level of improvement (weeks 4, 6, 8, 10, and 12)
- Decisions based on Quick Inventory of Depressive Symptoms (QIDS-C) score and side effect burden

Visit Frequency

- Patients seen weekly for the first 4 weeks of each Stage—or as often as possible
- Then visits every 2 weeks until 50% improvement (from baseline QIDS-C) maintained for at least 1 month
- Then visits every 4 weeks until 75% improvement maintained for at least 1 month
- Then visits every 3 months if in continuation phase

Measurement-Based Care—Assessing Depressive Symptomatology

- Quick Inventory of Depressive Symptoms (QIDS-C/-SR)
  - QIDS $\geq$ 9 = Minimal/no response
  - QIDS 6-8 = Partial response
  - QIDS $\leq$ 5 = Full response/remission

Assessing Side Effects

- Clinician advised to ask specifically about potential medication side effects
- FIBSER self-report scale completed
- Clinician and patient decide if side effects are tolerable or distressing

Assessing Treatment Adherence

- Patients asked to complete self-report questionnaire at each visit
- Provides estimate of adherence in previous week
- Provides information on reasons for nonadherence

Contact Info

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Clinical Decision Support to Improve Laboratory Monitoring and Timely Followup of Laboratory Testing

Steven R. Simon

VA Boston Healthcare System

Background

- **Medication monitoring**
  - Many medications require laboratory testing to assess efficacy and toxicity.
  - Recommended monitoring is often not performed, potentially leading to adverse drug events.

Background

- **Health information technology**
  - The use of health information technology and targeted clinical alerts at the time of prescribing may improve rates of appropriate laboratory monitoring.

Objective

- To determine the effect of computerized clinical decision support on adherence to recommended laboratory monitoring in ambulatory care settings.

Study Setting and Design

- Community-based primary care providers using an electronic health record with clinical decision support alert capability
- Randomized controlled trial
- Baseline period 6/1/10–5/31/11
- Intervention period 6/23/11–2/22/11

Intervention Design

- 32 target medications/classes, each requiring 1–6 laboratory tests
- Clinical decision support determined if indicated test(s) had been performed in preceding 365 days
- If not, alert was presented to the clinician at the time of medication ordering

Primary Outcome Measure

- The primary outcome was the proportion of medications with appropriate laboratory monitoring, defined as the completion of all indicated laboratory testing from 365 days prior to and until 14 days after the prescription date.

Patient Characteristics

Characteristics	Controls (n=10,541) Mean (SD)	Intervention (n=10,244) Mean (SD)
Age	59.6 (14.1)	60.0 (14.5)
Male, n (%)	4,026 (38.2)	4,591 (44.8)
Number of encounters[a], mean (SD)	6.6 (4.8)	4.5 (3.4)
Number of medications prescribed[a,b]	3.4 (1.5)	3.2 (1.5)
Number of medications prescribed on encounter date of interest[b]	3.0 (1.4)	2.8 (1.4)

Laboratory Monitoring

Baseline Time Period		Intervention Time Period	
Control Group O/E[a] (%)	Intervention Group O/E (%)	Control Group O/E (%)	Intervention Group O/E (%)
7,457 / 10,541 (70.7)	8,134 / 10,244 (79.4)	5,951 / 9,535 (62.4)	6,266 / 8,066 (77.7)

Key Findings Summary

- At baseline, practices were generally similar on measured demographic and clinical parameters, although some differences were apparent.
- During the baseline period, complete monitoring occurred for 70.7% of medications in control practices and 79.4% of medications in intervention practices.

Key Findings Summary

- During the intervention, complete monitoring occurred for 62.4% of medications in control practices and 77.7% in intervention practices.
- For medications requiring three or more laboratory tests, at most 17.7% had evidence of complete laboratory monitoring.

Limitations

- Results are not adjusted for patient comorbidities, provider characteristics, or practice features.
- Results are not clustered by provider.
- We were unable to determine whether laboratory testing was performed specifically to monitor a particular medication.

Conclusions and Implications

- Although adherence to laboratory monitoring recommendations decreased over time in both the intervention and control practices, this effect was less pronounced for the intervention group, suggesting that there may have been some effectiveness.

Conclusions and Implications

- Interventions may need to target both patients and clinicians to improve the complex behavior of laboratory monitoring of medications.

Contact Information

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Improving Adherence to Otitis Media Guidelines with Clinical Decision Support and Clinician Feedback

Alexander G. Fiks, M.D., M.S.C.E.

The Children's Hospital of Philadelphia Pediatric Research Consortium

Background: CDS

- Physicians commonly fail to adhere to practice guidelines.
- Clinical decision support (CDS) systems provide intelligently filtered, appropriately timed, and actionable information to clinicians at the point of care.
- Such systems help overcome barriers to guidelines-based treatment.

Background: Feedback

- Clinician feedback has been extensively studied as a means of delivering performance information to clinicians.
- No previous studies have investigated the combined effects of performance feedback in addition to CDS individualized to a patient's history and presentation.

Background: Otitis Media

- Otitis media (OM) is one of the most common disorders in childhood.
- Up to 60% of all children have experienced at least one OM episode by 1 year of age.
- OM is the third most common reason for a pediatric office visit and is the principal diagnosis in up to 12% of all office visits.
- The American Academy of Pediatrics and Centers for Disease Control and Prevention have developed guidelines for OM; however, studies have shown that adherence to guidelines remains low.

Study Objectives

- Aim 1: To assess the effects of electronic health record (EHR)-based CDS and physician performance feedback on adherence to guidelines for acute otitis media (AOM) and otitis media with effusion (OME).
- Aim 2: To describe the adoption of the OM CDS and the effect of performance feedback on adoption.

Methods

- **Design**:
  - Practices were cluster-randomized using a factorial design
- **Study population:**
  - 24 primary care practices within The Children's Hospital of Philadelphia's Pediatric Research Consortium (PeRC)
  - Randomization created 4 groups:
    - CDS + feedback (8 practices)
    - CDS only (8 practices)
    - Feedback only (4 practices)
    - Usual care (4 practices)

Study Phases

- Phase 1 (Baseline)—12 months; no practices received the intervention
- Phase 2 (CDS only)—11 months; 16 practices received CDS and 8 did not
- Phase 3 (CDS + feedback)—10 months; half of the practices in each group received feedback

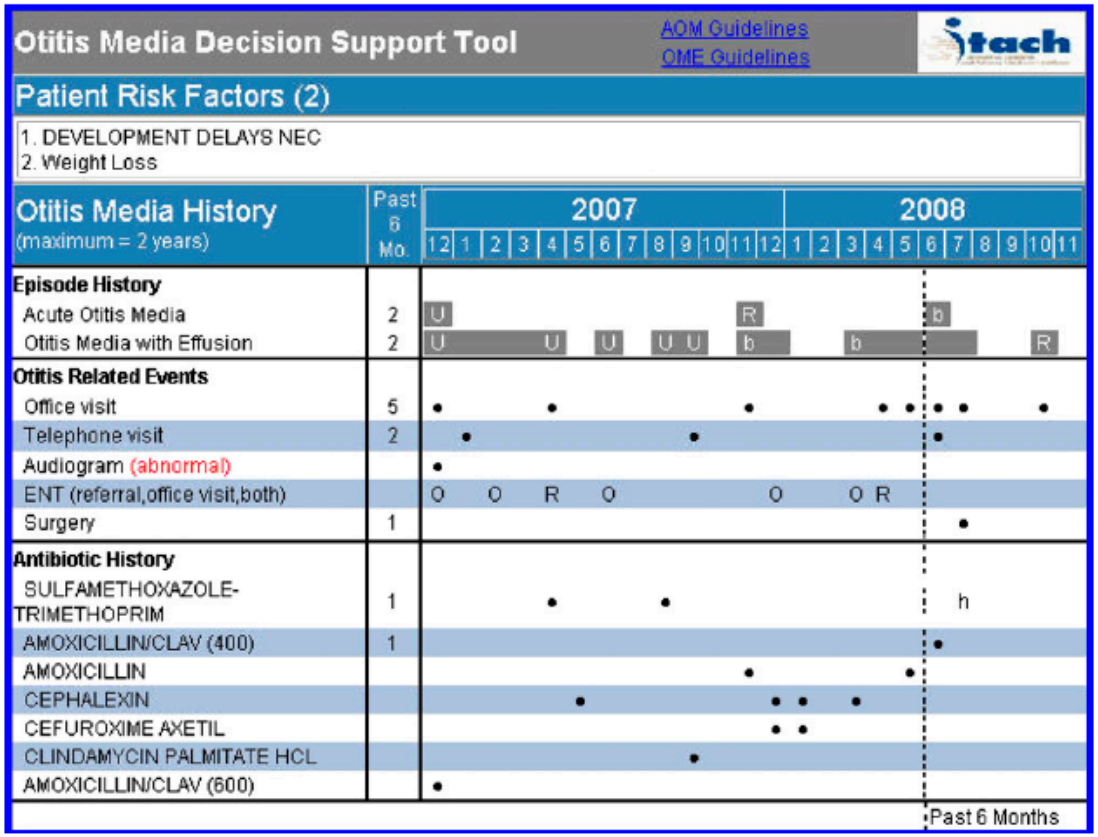
OM Quality Metrics

- All OM:
  - Pain assessed (pain score recorded)
  - Pain treated (analgesic prescribed or recommended)
- AOM:
  - Adequate diagnostic evaluation
  - Amoxicillin prescribed as first-line therapy
  - Appropriate antibiotics prescribed for penicillin-allergic patients
  - High-dose amoxicillin prescribed
  - Watchful waiting with uncomplicated AOM
- OME:
  - Adequate diagnostic evaluation
  - Avoidance of decongestants or antihistamines
  - Watchful waiting for OME

Clinical Decision Support System

- Developed by research team for the randomized clinical trial
- Delivered using a Web service
- Appears seamlessly in the EHR for children with current ear complaints or history of OM care
- Practices were trained regarding CDS use and OM guidelines in 1-hour, in-person sessions led by pediatricians on the research team

Visual Display of OM Events During Past 24 Months



This component appeared for any visit with an ear-related problem and provided an aggregated history of previous OM encounters and the child's antibiotic history.

Facilitates Documentation of the Clinical Encounter

History of Present Illness

The tympanic membrane is inflamed and bulging, consistent with Acute Otitis Media.

Physical Exam

General appearance: ○ Well ○ Ill

	Right	Left	Not assessed
Normal:	☐	☐	
Unable to visualize:	☐	☐	
TM Injected:	☐	☐	
Bulging:	☐	☐	
Otorrhea:	☐	☐	
Effusion/Air fluid level:	☐	☐	
Decreased mobility:	☐	☐	☐
Tubes in place:	☐	☐	
Perforation:	☐	☐	
Other:	☐	☐	

Cancel | Show suggested diagnosis/plan

History of Present Illness

Fever of 102.5°F (39.2°C) in the past 24 hours?
◉ Yes ○ No

Tmax: 104 Duration (days): 3

	Right	Left
Normal:	☐	☑
Otalgia:	☑	☐
Otorrhea:	☑	☐

Hearing/speech/balance concerns: ○ Yes ◉ No

Physical Exam

General appearance: ○ Well ◉ Ill

	Right	Left	Not assessed
Normal:	☐	☑	
Unable to visualize:	☐	☐	
TM Injected:	☑	☐	
Bulging:	☑	☐	
Otorrhea:	☑	☐	
Effusion/Air fluid level:	☐	☐	
Decreased mobility:	☑	☐	☐
Tubes in place:	☐	☐	
Perforation:	☐	☐	
Other:	☐	☐	

Cancel | Show suggested diagnosis/plan

This component included a data-gathering tool for recording OM-related history of the present illness and findings from the clinical exam.

Supports Clinicians' Ordering of Guidelines-based Care

Assessment and Plan

Type	AAP Guideline	Action	Reason Declined
Diagnosis	Acute Otitis Media	◉ Accept/Sign ○ Decline	
Analgesic	IBUPROFEN 100 mg/5 mL susp, give 150 mg (=1.5 tsp) po q6h prn	◉ Accept/Sign ○ Decline	
Documentation	Watchful waiting previously tried on 10/19/2008		
Antibiotic	AMOXICILLIN-CLAVULANATE 600 mg/5 mL susp, give 720 mg (=6 mL) po bid for 10 days	◉ Accept/Sign ○ Decline	
Antibiotic	OFLOXACIN 5 gtt bid to affected ear 10 days	◉ Accept/Sign ○ Decline	
Documentation	Otitis Media Progress Note	◉ Accept/Sign ○ Decline	

Cancel | Process Orders/Diagnosis...

This component displayed guidelines-based recommendations for treatment including indicated antibiotics, diagnosis, referral, analgesic use, and a link to a clinically appropriate order set. Also provided patient-specific discharge instructions.

Clinician Feedback

Quality Measure # 1:

High-Dose Amoxicillin for AOM when Amoxicillin was Prescribed

AMERICAN ACADEMY OF PEDIATRICS RECOMMENDATION:
"When amoxicillin is used, the dose should be 80 to 90 mg/kg per day. (This is based on extrapolation from microbiologic studies and expert opinion, with a preponderance of benefit over risk)"[1]

1. *Pediatrics* 2004; 113; 1451-1465

Your Performance (April 2010-June 2010)	Top Performers (April 2010-June 2010)
100%	**100%**

	Appropriate Amoxicillin Dosing			
Time Period	You		Your Practice	Network
	Number of AOM Visits with Amoxicillin prescribed	High Dose (≥ 60 mg/kg/day) of amoxicillin prescribed (*N*, %)	% High Dose (≥ 60 mg/kg/day)	% High Dose (≥ 60 mg/kg/day)
January 2010 through March 2010	**66**	**66 (100%)**	98%	78%
April 2010 through June 2010	**42**	**42 (100%)**	100%	82%

Quality Measure:

Numerator: Number of AOM Visits with High-Dose Amoxicillin
1. *If patient weight < 25kg then high dose was defined as ≥ 60 mg/kg/day*
2. *If patient weight ≥ 25kg then high dose was defined as ≥ 1500 mg/day*

Denominator: All Visits for AOM Satisfying Inclusion Criteria

Selection Criteria

Inclusion: Visit Diagnosis of AOM
Children 2 months to 12 years of age
Amoxicillin was prescribed at the visit

Provider =
Practice=
Study Group = Intervention

- After 11 months of CDS only, practices were cluster-randomized to receive feedback or not.
- Feedback documented physicians' level of CDS use and monthly adherence to OM guidelines, change in adherence over time, and compared to others in their practice and health system.

Methods

- Primary outcomes:
  - Aim 1: Adherence to OM guidelines
  - Aim 2: Adoption/CDS use at eligible visits
- Primary exposure:
  - Aim 1: Feedback, CDS use
  - Aim 2: Feedback
- Covariates:
  - Visit, clinician, and patient-level characteristics

Results

- Study sample:
  - Collected data from 139,306 OM visits between December 2007 and September 2010, made by 55,779 children at 24 study practices with 182 clinicians
    - Excluded visits with residents, visits with resolved OM, and visits with otitis externa
  - Adoption: analysis included only visits at sites with access to the CDS (41,391 visits at 16 practices with 108 clinicians)

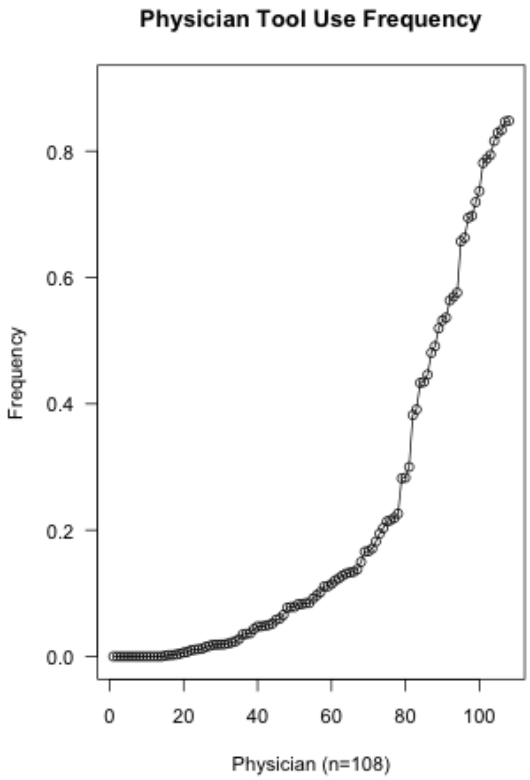
Results

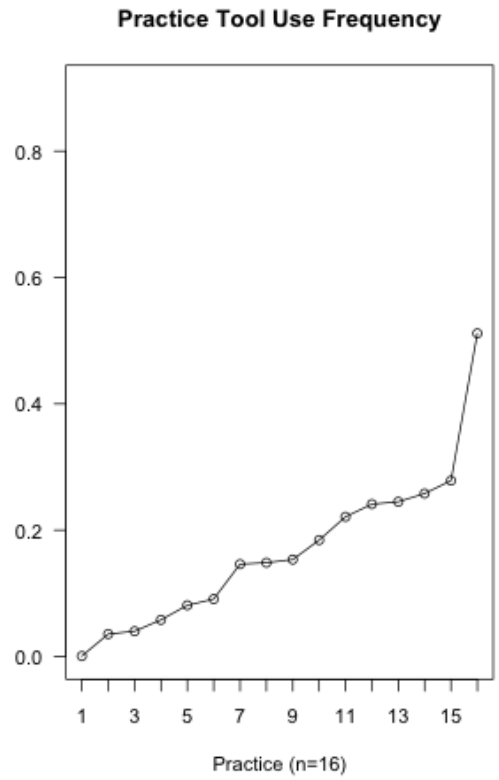
- Adherence to OM guidelines:
  - Comprehensive care (all recommended guidelines including antibiotic use adhered to) was accomplished for 15% of AOM visits and 5% of OME visits at baseline
  - Adherence to guidelines increased during intervention period
  - Larger increase for CDS vs. non-CDS visits for:
    - AOM comprehensive care: difference 4%, p=0.006
    - OME comprehensive care: difference 3%, p=0.03
    - Pain treatment: difference 6%, p=0.03
    - Adequate OME diagnostic evaluation: difference 5%, p=0.008
    - Amoxicillin as first-line therapy for AOM: difference 4%, p=0.001

Results

- Improvements in quality observed with feedback were similar to those observed with CDS.
- Joint effects of CDS and feedback were not additive.

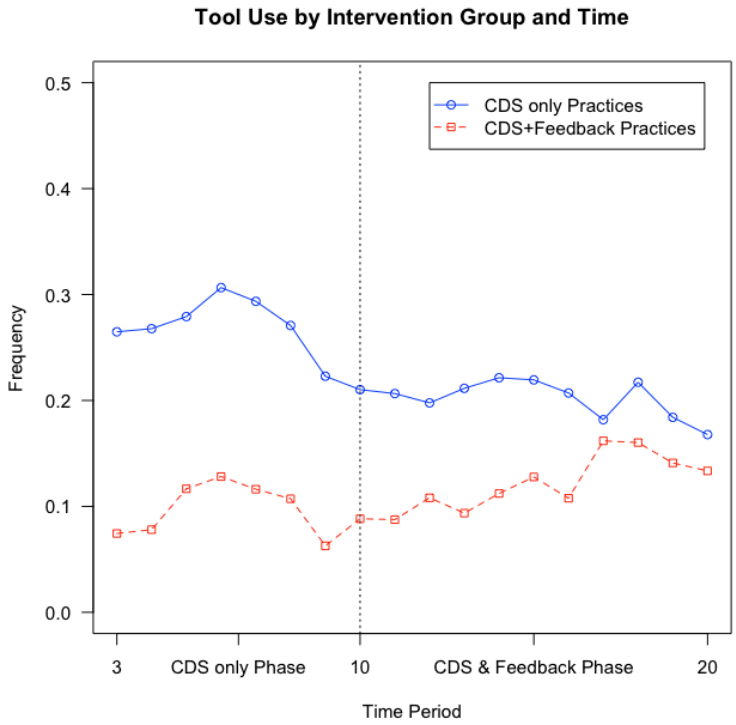
Overall CDS Use Frequency





- Clinicians used the CDS at a mean of 21.3% of eligible visits (median: 8.8%, range: 0-84.8%).
- Practices used the CDS at a mean of 16.8% of eligible visits (median: 15.1%, range 0-51%).

Impact of Feedback on CDS Use



- Among clinicians with access to CDS, feedback resulted in significant increases in CDS use.
- No feedback: 6.8% mean **decrease** in CDS use
- Feedback: 2.2% mean **increase**
  - Mean difference in difference of 9.0 percentage points (p=0.004)

Impact of CDS Use on Quality

- For all OM:
  - 48% relative increase in pain treatment ($p<0.001$)
- For AOM:
  - 5% increase in use of amoxicillin as a first-line therapy ($p=0.007$)
  - 5% increase in appropriate antibiotic for penicillin-allergic patients ($p=0.04$)
  - 17% increase in high-dose amoxicillin ($p=0.02$)
- For OME:
  - 12% increase in adequate diagnostic evaluation ($p=0.01$)
- Comprehensive quality measures:
  - For visits at which at least three quality measures were relevant, there was an increase in perfect care for AOM and OME (8%, $p<0.001$ and 9%, $p=0.01$, respectively)

Limitations

- This study was conducted at a single health care network in one region of the country.
- The limited time frame of the study prevents full understanding of how long feedback programs can influence provider behavior change, what happens when feedback is removed, or how long feedback must persist to achieve optimal effect.

Study Conclusions

- CDS and performance feedback were both effective strategies for improving adherence to OM guidelines, including antibiotic prescribing.
- Combining the two interventions was no better than either delivered alone.
- Low rates of CDS adoption call for strategies that foster CDS use.
- Implementing clinician feedback along with CDS effectively increased CDS adoption in this study.

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Q & A

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